Code No: R21043 **R10** SET - 1

II B. Tech I Semester Supplementary Examinations, Oct/Nov - 2017
PROBABILITY THEORY AND STOCHASTIC PROCESSES
(Electronics and Communications Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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1. a) Explain about total probability theorem. (8M)
   b) Explain about Bernoulli Trials. (7M)

2. a) Given that a random variable X has the following possible values, state if X is discrete, continuous, or mixed. (8M)
   i) $\{-20 < x < -5\}$
   ii) $\{10, 12 < x \le 14, 15, 17\}$
   iii) $\{4, 3, 1, 1, -2\}$
   b) The PDF of a random variable X is given by (7M)
   $f_X(x) = K\,\delta\,(x-5) + 0.05\,[u\,(x) - u\,(x-10)]$.
   i) Find K ii) Plot $f_x(x)$ iii) find $p\,(0 < X \le 5)$ iv) Find $p(0 < X < 5)$

3. a) State and prove Chebychev's inequality (7M)
   b) Find mean and variance of binomial density function (8M)

4. a) Random variables X and Y have respective density functions (8M)
   $$f_X(x) = \frac{1}{a}[u(x) - u(x-a)]$$
   $$f_Y(y) = \frac{1}{b}[u(y) - u(y-b)]$$
   Where b>a and a>0. Find and sketch the density functions of W= X + Y if X and Y are statistically independent.
   b) Explain properties of joint density and distribution functions. (7M)

5. a) For two random variables X and Y (7M)
   $$f_{X,Y}(x,y) = 0.15\,\delta(x+1)\delta(y) + 0.1\,\delta(x)\delta(y) + 0.1\,\delta(x)$$
   $$+\,\delta(y-2) + 0.4\,\delta(x-1)\delta(y+2) +$$
   $$0.2\,\delta(x-1)\delta(y-1) + 0.5\,\delta(x-1)\delta(y-3).$$
   Find the correlation coefficients of X and Y.
   b) Two random variables having joint characteristic function (8M)
   $\emptyset_{XY}(\omega_1, \omega_2) = \exp(-2\omega^2_1 - 8\omega^2_2)$. Find moment's m_{10}, mo_1, m_{11}?
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6. a) The two-level semi random binary process is defined by (7M)
   X(t) = A or –A (n-1)< t< nT Where the levels A and –A occurs with equal probability, T is positive constant, and n=0, $\pm 1, \pm 2, \ldots$.
   i) Sketch a typical sample function
   ii) Classify the process
   iii) Is the process deterministic

   b) Assume that an ergodic random process X(t) has an autocorrelation function (8M)

   $$R_{xx}(\tau) = 18 + \frac{2}{6+\tau^2}[1 + 4\cos(12\tau)]$$

   i) Find $|\overline{X}|$
   ii) Does this process have a periodic component?
   iii) What is the average power in X(t)?

7. a) Derive the relationship between power spectrum and autocorrelation. (8M)
   b) Given a random process $X(t) = A\cos\omega_0 t$, where ω_0 is a constant and A is uniformly distributed with mean 5 and variance 2. Find the average power of X(t). (7M)

8. A random noise X(t), having a power spectrum (16M)

   $$S_{XX}(\omega) = \frac{3}{49+\omega^2}$$

   is applied to a differentiator with transform function $H_1(\omega) = j\,\omega$. The differentiator's output is applied to a network for which $h_2(t) = u(t)t2\exp(-7t)$
   The network's response is a noise denoted by Y(t).
   a)What is the average power in X(t)
   b)Find the power spectrum of Y(t)